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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/763,673	01/22/2004	Frederic Perriot	20423-08166	7489

34415 7590 05/04/2007

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EXAMINER	
MORAN, RANDAL D	
ART UNIT	**PAPER NUMBER**
2135	

NOTIFICATION DATE	DELIVERY MODE
05/04/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/763,673	PERRIOT, FREDERIC	
	Examiner	Art Unit	
	Randal D. Moran	2135	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 January 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☒ Claim(s) *1-27* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *22 January 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *4/12/2004 and 4/22/2005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. The Information Disclosure Statements filed on 4/12/2004 and 4/22/2005 have been considered by the examiner.

2. Claims 1-27 are pending in the application.

3. Below, Examiner has pointed out particular references contained in the prior art(s) of record in the body of this action for the convenience of the applicant. Although the specified citations are representative of the teachings in the art and are applied to the specific limitations within the individual claims, other passages and figures may apply as well. Applicant should consider the entire prior art as applicable as to the limitations of the claims. It is respectfully requested from the applicant, in preparing the response, to consider fully each reference in its entirety as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior arts or disclosed by the examiner.

Claim Rejections - 35 USC § 101

1. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

2. **Claims 1-26** are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter, as they do not fall under any of the statutory classes of inventions. The language in the specification (p. 3- line 28, p. 4- lines 1-2) and claims raise an issue because the claims are directed merely to an abstract idea that is not tied to an article of manufacture which would result in a practical application producing a useful, concrete, and tangible result to form the basis of statutory subject matter under 35 U.S.C. 101.

- Considering **Claims 1, 6, 14,** could reasonably be drawn to functional descriptive material, per se, i.e., "program" may be taken to mean software alone, and as such, the methods of claims 1, 6, 14, and 24, would be directed to non-statutory subject matter.
- Considering **Claims 20 and 24,** could reasonably be drawn to functional descriptive material, per se, i.e., "program" may be taken to mean software alone, and as such, the apparatus of claim 20 and the computer readable medium (CRM) of claim 24, would be directed to non-statutory subject matter. The specification states that "When implemented in software, these modules can reside on any (CRM) computer-readable medium or media such as a hard disk, floppy disk, optical disk, etc." (p. 3- line 28, p. 4- lines 1-2). The modules, when implemented in software residing on a CRM are non-statutory until they are executed and produce a useful, concrete, and tangible result.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. **Claims 5-13** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

- Considering **Claims 5 and 6,** by applicants' definition, "code having a decryption loop and a body," is malicious code (p. 3- lines 17-22). Therefore, it is unclear how to determine if these items contain malicious code as claimed.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims rejected under 35 U.S.C. 102(b) as being anticipated by **Yamamoto (US 5,881,151)**, hereafter "Yamamoto".

3. Considering **Claims 1 and 24,** Yamamoto discloses a method for determining whether computer code contains malicious code (abstract), said method comprising the steps of: optimizing the computer code to produce optimized code (column 4- lines 51-55, column 5- lines 26-38, Fig. 3- item 38); and subjecting the optimized code to a malicious code detection protocol (column 6- lines 1-4 and 38-50, Fig. 5, Fig. 10).

4. Considering **Claims 2 and 25,** Yamamoto discloses the malicious code detection protocol is a protocol from the group of protocols consisting of pattern matching, emulation, check summing, heuristics, tracing, X-raying, and algorithmic scanning (column 7- lines 51-56, column 8- lines 7-20, Fig. 10).

5. Considering **Claims 3 and 26,** Yamamoto discloses the optimizing step comprises performing at least one technique from the group of techniques consisting of constant folding, copy propagation, non-obvious dead code elimination, code motion, peephole optimization, abstract interpretation, instruction specialization, and control flow graph reduction (column 5- lines 32-38)

6. Considering **Claim 4,** Yamamoto discloses at least two of said techniques are combined synergistically (column 5- lines 26-38).

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. **Claims 5-13** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Yamamoto** in view of **Nachenberg (US 5,826,013)**, hereafter "Nachenberg".

3. Considering **Claim 5,** Yamamoto discloses optimizing code prior to performing virus detection (Fig. 3).

Yamamoto is silent on the computer code is polymorphic code comprising a decryption loop and a body; and the optimizing step comprises optimizing just the decryption loop.

Nachenberg discloses the computer code is polymorphic code (column 1- lines 14-17) comprising a decryption loop and a body (column 1- lines 25-33); and the optimizing step comprises optimizing just the decryption loop (column 6- lines 54-67, column 7- lines 1-8, Fig. 2- item 200).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Yamamoto to optimize just the decryption loop as taught by Nachenberg in order to substantially reduce the number of file instructions that must be emulated in order to determine whether a target file is infected by a virus (Nachenberg- column 6- lines 56-59).

4. Considering **Claim 6,** Yamamoto discloses optimizing code prior to performing virus detection (Fig. 3).

Yamamoto is silent on optimizing the decryption loop to produce optimized loop code; performing a malicious code detection procedure on the optimized loop code; optimizing the body to produce optimized body code; and subjecting the optimized body code to a malicious code detection protocol.

Nachenberg discloses optimizing the decryption loop to produce optimized loop code (column 6- lines 54-67, column 7- lines 1-8, Fig. 2- item 200); performing a malicious code detection procedure on the optimized loop code (column 6- lines 54-67, column 7- lines 1-8, Fig. 2- item 200); optimizing the body to produce optimized body code (column 6- lines 54-67, column 7- lines 1-8, Fig. 2- item 200); and subjecting the optimized body code to a malicious code detection protocol (column 8- lines 18-37).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Yamamoto to optimize just the decryption loop as taught by Nachenberg in order to substantially reduce the number of file instructions that must be emulated in order to determine whether a target file is infected by a virus (Nachenberg- column 6- lines 56-59).

5. Considering **Claims 7 and 8,** the combination of Yamamoto and Nachenberg discloses the malicious code detection protocol is a protocol from the group of protocols consisting of pattern matching, emulation, check summing, heuristics, tracing, X-raying, and algorithmic scanning (Yamamoto- column 7- lines 51-56, column 8- lines 7-20, Fig. 10).

6. Considering **Claim 9,** the combination of Yamamoto and Nachenberg discloses the step of optimizing the body comprises using at least one output from the group of steps consisting of optimizing the decryption loop and performing a malicious code detection procedure on the optimized loop code (Yamamoto- Fig. 3- item 38, Nachenberg- column 6- lines 63-65, column 7- lines 64-67, column 8- lines 1-4).

7. Considering **Claim 10,** the combination of Yamamoto and Nachenberg discloses when the step of performing a malicious code detection procedure on the optimized loop code indicates the presence of malicious code in the computer code, the steps of optimizing the body and subjecting the optimized body code to a malicious code detection protocol are aborted (Nachenberg- column 11- lines 2-7).

8. Considering **Claims 11 and 12,** the combination of Yamamoto and Nachenberg discloses after the step of performing a malicious code detection procedure on the optimized loop code, revealing an encrypted body (Nachenberg- column 9- lines 33-38).

9. Considering **Claim 13,** the combination of Yamamoto and Nachenberg discloses the step of revealing an encrypted body comprises applying a key gleaned from the optimized loop code (Nachenberg- column 5- lines 52-58, column 9- lines 33-38).

10. **Claims 14-18 and 20-23** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Yamamoto** in view of **Chan et al. (US 5,734,908)**, hereafter "Chan".

11. Considering **Claim 14,** Yamamoto discloses a method for optimizing computer code that is suspected of containing malicious code (abstract).

Yamamoto does not explicitly disclose performing a forward pass operation; performing a backward pass operation; performing a control flow graph reduction; and iterating the above three steps a plurality of times.

Chan does disclose performing a forward pass operation (column 10- lines 34-47 and 56-67, Fig. 5- item 510); performing a backward pass operation (column 6- lines 14-33 and 43-57, Fig. 4A); performing a control flow graph reduction (column 6- lines 1-6); and iterating the above three steps a plurality of times (column 6- lines 14-33, column 7- lines 17-25, Fig. 4A, Fig. 5).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Yamamoto by performing a forward pass operation; performing a backward pass operation; performing a control flow graph reduction; and iterating the above three steps a plurality of times as taught by Chan in order to more fully utilize the resources of the target machine, thereby enhancing system performance. In particular, the GID unit 116 distributes (moves) instructions from one basic block to other basic blocks (in either the forward or backward direction). The GID unit 116 performs this instruction distribution/movement optimization when it is profitable to do so from an execution viewpoint (that is, when such instruction movement would

result in faster executing and tighter resource-utilized object code 118) (Chan- column 3- lines 10-20).

12. Considering **Claim 15,** the combination of Yamamoto and Chan discloses the iteration of the three steps stops after either: a pre-selected number of iterations; or observing that no optimizations of the computer code were performed in the most recent iteration (Chan- column 7- lines 36-45, column 11- lines 38-41, Fig. 4A, Fig. 5).

13. Considering **Claim 16,** the combination of Yamamoto and Chan discloses the step of performing a code motion procedure, wherein the four steps are iterated a plurality of times (Chan- column 6- lines 14-34).

14. Considering **Claim 17,** the combination of Yamamoto and Chan discloses the forward pass operation comprises at least one of the following steps: peephole optimization; constant folding; copy propagation; forward computations related to abstract interpretation; and instruction specialization (Chan- column 10- lines 34-47, Fig. 5- item 510).

15. Considering **Claim 18,** the combination of Yamamoto and Chan discloses the backward pass operation comprises at least one of the steps of backward

computations related to abstract interpretation and local dead code elimination (Yamamoto- column 5- lines 26-38).

16. Considering **Claim 20,** Yamamoto discloses an apparatus for countering malicious computer code (abstract).

Yamamoto does not explicitly disclose a peephole optimizer; coupled to the peephole optimizer, a state tracking module; and coupled to the peephole optimizer and to the state-tracking module, an instruction specialization module.

Chan does explicitly disclose a peephole optimizer (column 10- lines 34-47, Fig. 5- item 510); coupled to the peephole optimizer, a state tracking module (column 11- lines 34-37, Fig. 5- item 513); and coupled to the peephole optimizer and to the state-tracking module, an instruction specialization module (column 12- lines 60-67, column 13- lines 1-20, Fig. 1- item 152).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Yamamoto by a peephole optimizer, a state tracking module, and an instruction specialization module as taught by Chan in order to more fully utilize the resources of the target machine, thereby enhancing system performance. In particular, the GID unit 116 distributes (moves) instructions from one basic block to other basic blocks (in

either the forward or backward direction). The GID unit 116 performs this instruction distribution/movement optimization when it is profitable to do so from an execution viewpoint (that is, when such instruction movement would result in faster executing and tighter resource-utilized object code 118) (Chan- column 3- lines 10-20).

17. Considering **Claim 21,** the combination of Yamamoto and Chan discloses a virtual state memory module coupled to the state-tracking module (Chan- column 11- lines 34-37, Fig. 5- item 513).

18. Considering **Claim 22,** the combination of Yamamoto and Chan discloses a driver module coupled to the instruction specialization module and to the state-tracking module (Chan- column 3- lines 46-53, Fig. 1- item 116).

19. Considering **Claim 23,** the combination of Yamamoto and Chan discloses the peephole optimizer comprises an instruction-reordering module (Chan- column 10- lines 56-67).

20. **Claim 19** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Yamamoto** and **Chan** in view of **Lovett et al. (US 2004/0221279)**, hereafter "Lovett".

21. Considering **Claim 19,** the combination of Yamamoto and Chan does not explicitly disclose the backward pass operation comprises the additional step of global dead code elimination.

Lovett does explicitly disclose the backward pass operation comprises the additional step of global dead code elimination ([0091]- line 6, [0104]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the combination of Yamamoto and Chan by adding the additional step of global dead code elimination as taught by Lovett in order to transform the IR (intermediate representation) to remove dead regions and thereby reduce the amount of work that must be performed by the target code (Lovett- [0104] lines 8-10).

22. **Claim 27** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Yamamoto** in view of **Lovett.**

23. Considering **Claim 27,** Yamamoto discloses a method for determining whether computer code contains malicious code (abstract), said method comprising the steps of: performing a dead code elimination procedure on the computer code (column 5- lines 26-38, Fig. 3); declaring a suspicion of malicious code in the computer code (column 6- lines 31-37, Fig. 10- S5).

Yamamoto does not explicitly disclose noting the amount of dead code eliminated during the dead code elimination procedure and when the amount of dead code eliminated during the dead code elimination procedure exceeds a pre-selected dead code threshold.

Lovett discloses performing a dead code elimination procedure on the computer code ([0104], Fig. 6- item 75); noting the amount of dead code eliminated during the dead code elimination procedure ([0107]); and when the amount of dead code eliminated during the dead code elimination procedure exceeds a pre-selected dead code threshold ([0133], [0144], [0091] lines 1-2, [0098] lines 9-27).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Yamamoto by noting the amount of dead code eliminated during optimization and declaring a suspicion of malicious code when that amount exceeds a certain threshold in order to prevent the further spread of the virus infection. By outputting the message of the interruption of the process due to the virus infection on the operator console together with the program name or the program number of the object program at the time of interrupting the process, virus infection of a specific program or OS can be notified (Lovett- column 7- lines 43-50).

Conclusion

1. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- US 2002/0131404 – Optimizing suspected malicious code.
- US 5,765,030 – Detecting polymorphic virus.
- US 5,485,575 – "Degarbling head".
- US 6,782,487 – Detection of mutating viruses.
- US 2003/0135791 – Decryption loop and body in polymorphic virus.
- US 2004/0221280 – Partial dead code elimination optimization.
- US 2003/0221121 – Static Single Assignment (SSA).
- US 2005/0204348 – Protecting code by obfuscation through optimization techniques.
- US 5,812,854 – Components of a compiler.
- US 5,797,013 – Loop unrolling.
- US 5,790,867 – Multi-Pass compiler with extended redundant copy elimination.
- US 2004/0255279 – Logs amount of dead code and reacts to reaching trigger threshold.
- US 5,659,752 – Outputs compiler information to a log file.
- US 2003/0149969 – Eliminating dead code based on a list.

2. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Randal D. Moran whose telephone number is 571-270-1255. The examiner can normally be reached on M-F: 7:00 - 4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kim Vu can be reached on 571-272-3859. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Randal D. Moran
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4/27/07

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